# Multiplication of Polynomials

## Unit: Algebra - Student Practice Worksheet

***Overview: Meera cut a rectangle of graph paper into four smaller rectangles with one horizontal and one vertical cut. "Add up the four areas," she told Arjun, "and you've just multiplied two polynomials without writing a single times sign." Arjun counted the squares. Then he tried it with algebra instead of numbers, and the same four pieces appeared.***

## Practice Questions (30 Total)

### Section A - Easy

**Q1. Teal x-strip times (x + 3). What is the product?**

x times (x + 3)

- ☐ **A.** x + 3
- ☐ **B.** $x^2 + 3x$
- ☐ **C.** $x^2 + 3$
- ☐ **D.** 3x

**Q2. To multiply (x + 2)(x + 5), what must you do to every term?**

- ☐ **A.** Add only the first terms
- ☐ **B.** Multiply only the last terms
- ☐ **C.** Add the two brackets together
- ☐ **D.** Multiply every term in the first bracket by every term in the second

**Q3. What does the letter F in FOIL stand for?**

- ☐ **A.** Final
- ☐ **B.** Full
- ☐ **C.** First
- ☐ **D.** Factor

**Q4. Two-term times three-term area grid. How many small rectangles?**

2 by 3 grid of products

- [ ] **A.** 3
- [ ] **B.** 5
- [ ] **C.** 9
- [ ] **D.** 6

**Q5. Are 3x and 3x² like terms?**

- [ ] **A.** Yes, both have an x
- [ ] **B.** No — different powers of x
- [ ] **C.** Yes, both have coefficient 3
- [ ] **D.** Only if x = 1

**Q6. In (x + 3)(x + 4), what is the product of the two 'Last' terms?**

- [ ] **A.** 7
- [ ] **B.** $x^2$
- [ ] **C.** 12
- [ ] **D.** 4x

**Q7. Two teal bars labelled 3x and 5x. Combine them.**

3x + 5x

- [ ] **A.** 8x
- [ ] **B.** 15x
- [ ] **C.** $8x^2$
- [ ] **D.** $15x^2$

**Q8. Why does FOIL fail on (x + 2)(x² + 3x + 1)?**

- [ ] **A.** The second bracket has three terms, not two
- [ ] **B.** $x^2$ cannot be multiplied
- [ ] **C.** FOIL only works with numbers
- [ ] **D.** The brackets are not the same size

**Q9. After multiplying out two brackets, what must you always do before calling it finished?**

- A. Nothing more is needed
- B. Divide by the number of terms
- C. Combine like terms
- D. Multiply again

**Q10. In the area picture, what does one small rectangle stand for, and why do you add them?**

- A. A leftover remainder
- B. One product term in the expansion
- C. The total answer
- D. A mistake to ignore

## Section B - Medium

**Q11. Four tiles for (x+2)(x+5). Expanded product?**

(x+2)(x+5) area

- A. $x^2 + 7x + 10$
- B. $x^2 + 10x + 7$
- C. $x^2 + 7x + 7$
- D. $x^2 + 10$

**Q12. How many individual product terms result before simplifying when multiplying a three-term bracket by a three-term bracket?**

- A. 6
- B. 9
- C. 3
- D. 12

**Q13. Expand (x – 3)(x + 6).**

- A. $x^2 + 9x – 18$
- B. $x^2 + 3x – 18$

- [ ] **C.** $x^2 - 3x - 18$
- [ ] **D.** $x^2 + 3x + 18$

**Q14. Expand (2x+1)(x+3) by FOIL, then combine like x-terms.**

$2x+1 \quad \times \quad x+3$

- [ ] **A.** $2x^2 + 7x + 3$
- [ ] **B.** $2x^2 + 3x + 7$
- [ ] **C.** $2x^2 + 4x + 3$
- [ ] **D.** $3x^2 + 7x + 3$

**Q15. Expand (x + 4)(x – 4).**

- [ ] **A.** $x^2 + 16$
- [ ] **B.** $x^2 - 8x - 16$
- [ ] **C.** $x^2 + 8x - 16$
- [ ] **D.** $x^2 - 16$

**Q16. Expand (3x – 2)(2x – 1).**

- [ ] **A.** $6x^2 - 3x + 2$
- [ ] **B.** $6x^2 + 7x + 2$
- [ ] **C.** $6x^2 - 7x + 2$
- [ ] **D.** $5x^2 - 7x + 2$

**Q17. Rectangle sides x+6 and x+2. Area as a polynomial?**

sides x+6 and x+2

- [ ] **A.** $x^2 + 12x + 8$
- [ ] **B.** $x^2 + 8x + 8$
- [ ] **C.** $2x + 8$
- [ ] **D.** $x^2 + 8x + 12$

**Q18. Expand $2x(x^2 + 3x - 1)$.**

- A. $2x^3 + 6x^2 – 2x$
- B. $2x^3 + 3x^2 – 1$
- C. $2x^3 + 6x^2 – 1$
- D. $x^3 + 6x^2 – 2x$

**Q19. Expand $(x + 1)(x^2 + 2x + 3)$.**

- A. $x^3 + 2x^2 + 3x + 3$
- B. $x^3 + x^2 + 5x + 3$
- C. $x^3 + 3x^2 + 5x + 3$
- D. $x^3 + 3x^2 + 3x + 3$

**Q20. Expand $–x(x–5)$, watching the two-minus product that becomes +5x.**

- A. $-x^2 – 5x$
- B. $-x^2 + 5x$
- C. $x^2 – 5x$
- D. $-x + 5x$

## Section C - Challenge

**Q21. First (x+1)(x+2), then times (x+3). Full expansion?**

$(x+1)(x+2) \quad \times \quad (x+3)$

- A. $x^3 + 6x^2 + 11x + 6$
- B. $x^3 + 5x^2 + 6x + 6$
- C. $x^3 + 6x^2 + 6x + 11$
- D. $x^3 + 3x^2 + 11x + 6$

**Q22. A rectangular field has length $(2x + 5)$ m and width $(x – 3)$ m. For what values of x is this width actually positive (a valid field)?**

- A. $x < 3$
- B. $x > 3$
- C. $x > 5$
- D. $x > 0$

**Q23. Expand $(2x - 1)(x^2 + x - 3)$.**

- **A.** $2x^3 + 2x^2 - 7x + 3$
- **B.** $2x^3 + x^2 - 7x + 3$
- **C.** $2x^3 + x^2 - 6x + 3$
- **D.** $2x^3 - x^2 - 7x + 3$

**Q24. Rectangle area $x^2+7x+12$, one side $x+3$. Other side?**

area $x^2+7x+12$, side $x+3$

- **A.** $(x + 4)$
- **B.** $(x + 9)$
- **C.** $(x + 3)$
- **D.** $(x + 12)$

**Q25. Expand $(a + b + c)(a + b - c)$ using grouping (let $s = a + b$).**

- **A.** $a^2 + b^2 - c^2$
- **B.** $(a+b)^2 + c^2$
- **C.** $(a+b)^2 - c^2$
- **D.** $a^2 + b^2 + c^2$

**Q26. Simplify $(x + 2)(x + 3) - (x + 1)(x + 4)$.**

- **A.** 0
- **B.** -2
- **C.** 2
- **D.** $2x + 2$

**Q27. Expand $(x^2+2x+1)(x-1)$ and combine like powers.**

$x^2+2x+1 \quad \times \quad x-1$

- **A.** $x^3 + x^2 - x - 1$
- **B.** $x^3 + 3x^2 + x - 1$
- **C.** $x^3 + x^2 + x - 1$

- [ ] **D.** $x^3 – x^2 – x – 1$

**Q28. If $(x + k)(x + 3)$ expands to $x^2 + 8x + 15$, find k.**

- [ ] **A.** 3
- [ ] **B.** 8
- [ ] **C.** 15
- [ ] **D.** 5

**Q29. Expand $(x – 2)^2 (x + 2)$ by first squaring, then multiplying.**

- [ ] **A.** $x^3 + 2x^2 – 4x + 8$
- [ ] **B.** $x^3 – 4x^2 – 4x + 8$
- [ ] **C.** $x^3 – 2x^2 + 4x + 8$
- [ ] **D.** $x^3 – 2x^2 – 4x + 8$

**Q30. Expand $(x+y)(x–y)(x+y)$ by grouping a difference of squares first.**

- [ ] **A.** $x^3 – y^3$
- [ ] **B.** $x^3 + x^2y – xy^2 – y^3$
- [ ] **C.** $x^2 – y^2$
- [ ] **D.** $x^3 + y^3$

## Answer Key

**Q1:** (B) (b) $x^2 + 3x$. x times x gives $x^2$, and x times 3 gives 3x — both terms of the bracket must be multiplied by x.

**Q2:** (D) (d) Multiply every term in the first bracket by every term in the second. This is the distributive law, the one rule behind all bracket multiplication.

**Q3:** (C) (c) First — multiply the first term of each bracket together. FOIL only applies to two two-term brackets.

**Q4:** (D) (d) 6, since 2 terms × 3 terms = 6 individual products, before any of them combine as like terms.

**Q5:** (B) (b) No — different powers of x. Like terms need the exact same letter part AND the same power; x and $x^2$ are not the same.

**Q6:** (C) (c) 12, since 3 × 4 = 12. Option (a) is their sum, not their product.

**Q7:** (A) (a) 8x. Add the coefficients (3+5=8) and keep the letter part x unchanged — you never multiply the exponents when combining like terms.

**Q8:** (A) (a) The second bracket has three terms, not two — FOIL only has four letters because it assumes exactly 2×2 products, which isn't enough here.

**Q9:** (C) (c) Combine like terms. An expanded-but-unsimplified expression (with separate like terms still listed) is not a finished answer.

**Q10:** (B) (b) One product term in the expansion. Adding up every small rectangle's area gives the full expanded product.

**Q11:** (A) (a) $x^2 + 7x + 10$. The middle term is the sum 2+5=7, and the constant is the product 2×5=10 — option (b) has swapped these two roles.

**Q12:** (B) (b) 9, since 3 terms × 3 terms = 9 products, some of which may combine afterward as like terms.

**Q13:** (B) (b) $x^2 + 3x - 18$. Sum of –3 and 6 is 3, and their product is –18 — the sign of each original term carries through the whole calculation.

**Q14:** (A) (a) $2x^2 + 7x + 3$. FOIL: First $2x \cdot x = 2x^2$, Outer $2x \cdot 3 = 6x$, Inner $1 \cdot x = x$, Last $1 \cdot 3 = 3$; combine $6x + x = 7x$.

**Q15:** (D) (d) $x^2 - 16$, matching $(a+b)(a-b) = a^2 - b^2$ from the identities topic — a special case where the outer and inner terms cancel.

**Q16:** (C) (c) $6x^2 - 7x + 2$. Outer –3x, Inner –4x combine to –7x; both original terms are negative so the product of the last terms is positive.

**Q17:** (D) (d) $x^2 + 8x + 12$. Area = length × width = $(x+6)(x+2) = x^2 + 2x + 6x + 12 = x^2 + 8x + 12$.

**Q18:** (A) (a) $2x^3 + 6x^2 - 2x$. Every one of the three terms inside must be multiplied by 2x, not just the first one.

**Q19:** (C) (c) $x^3 + 3x^2 + 5x + 3$. Distribute x and 1 across all three terms: $x^3 + 2x^2 + 3x + x^2 + 2x + 3$, then combine $2x^2 + x^2 = 3x^2$ and $3x + 2x = 5x$.

**Q20:** (B) (b) $-x^2 + 5x$. Multiplying -x by -5 gives +5x — a common slip is to keep the sign negative when two negatives should give a positive.

**Q21:** (A) (a) $x^3 + 6x^2 + 11x + 6$. Multiply the first two brackets to get $x^2+3x+2$, then multiply that by $(x+3)$: $x^3+3x^2+2x + 3x^2+9x+6 = x^3+6x^2+11x+6$.

**Q22:** (B) (b) $x > 3$. The width $(x – 3)$ is only positive when x is greater than 3 — a reminder that expanding an expression doesn't excuse checking it makes physical sense.

**Q23:** (B) (b) $2x^3 + x^2 – 7x + 3$. Distribute: $2x^3+2x^2–6x$, then $–x^2–x+3$; combine $2x^2–x^2=x^2$ and $–6x–x=–7x$.

**Q24:** (A) (a) $(x + 4)$. Check by multiplying: $(x+3)(x+4) = x^2 + 7x + 12$, matching the given area exactly.

**Q25:** (C) (c) $(a+b)^2 – c^2$. Grouping $(a+b)$ as s turns this into $(s+c)(s–c) = s^2 – c^2 = (a+b)^2 – c^2$, reusing the difference-of-squares identity.

**Q26:** (C) (c) 2. First expand: $(x^2+5x+6) – (x^2+5x+4) = 2$. Both expansions share the same $x^2$ and x terms, which cancel, leaving only the constants' difference.

**Q27:** (A) (a) $x^3 + x^2 – x – 1$. Distribute: $x^3+2x^2+x$, then $–x^2–2x–1$; combine $2x^2–x^2=x^2$ and $x–2x=–x$.

**Q28:** (D) (d) 5. Since the constant term must be $k×3=15$, $k=5$; checking the middle term, $5+3=8$, confirms it matches.

**Q29:** (D) (d) $x^3 – 2x^2 – 4x + 8$. First $(x–2)^2 = x^2–4x+4$, then $(x^2–4x+4)(x+2) = x^3+2x^2–4x^2–8x+4x+8 = x^3–2x^2–4x+8$.

**Q30:** (B) (b) $x^3 + x^2y – xy^2 – y^3$. First $(x+y)(x–y) = x^2–y^2$, then multiply by $(x+y)$: $x^3+x^2y–xy^2–y^3$.

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***You've got this! Keep learning and shining! - Ruchi Math Coaching***